

# PATENT COOPERATION TREATY

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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)



(PCT Article 36 and Rule 70)

Applicant's or agent's file reference RJ/P89452PWO	<b>FOR FURTHER ACTION</b> See Form PCT/PEA/416	
International application No. PCT/GB2004/003018	International filing date (day/month/year) 12.07.2004	Priority date (day/month/year) 02.08.2003
International Patent Classification (IPC) or national classification and IPC H01L29/423, H01L29/417, H01L29/732		
Applicant ZETEX PLC et al.		

- This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.
- This report is also accompanied by ANNEXES, comprising:
  - ☐ sent to the applicant and to the International Bureau) a total of sheets, as follows:
    - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
    - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
  - ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

- This report contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

Date of submission of the demand  31.05.2005	Date of completion of this report  10.11.2005
Name and mailing address of the International preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Berthold, K  Telephone No. +49 89 2399-2632 

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/GB2004/003018

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-7 as originally filed

**Claims, Numbers**

1-6 received on 31.05.2005 with letter of 27.05.2005

**Drawings, Sheets**

1/1 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-5
	No: Claims	6
Inventive step (IS)	Yes: Claims	
	No: Claims	1-5
Industrial applicability (IA)	Yes: Claims	1-6
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

- 1 The following documents are referred to in this communication:

- D1 : SEI-HYUNG RYU ET AL: "1.8 kV, 3.8 A bipolar junction transistors in 4H-SiC"  
PROCEEDINGS OF THE 13TH. INTERNATIONAL SYMPOSIUM ON POWER  
SEMICONDUCTOR DEVICES & ICS. ISPSD'01. OSAKA, JAPAN, JUNE 4 - 7,  
2001, INTERNATIONAL SYMPOSIUM ON POWER SEMICONDUCTOR  
DEVICES & IC'S, NEW YORK, NY : IEEE, US, 4 June 2001 (2001-06-04),  
pages 37-40, XP010551565 ISBN: 4-88686-056-7C
- D2 : EP 0 341 221 A (SGS THOMSON MICROELECTRONICS) 8 November 1989  
(1989-11-08)
- D3: PATENT ABSTRACTS OF JAPAN of JP 62 244170 A (SANYO ELECTRIC CO  
LTD), 24 October 1987 (1987-10-24)

- 2 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 6 is not new in the sense of Article 33(2) PCT.

The general wording of claim 6 does not meet the requirements of Rule 6.2 PCT (see section VIII) since it refers to a drawing. Furthermore, the general wording of claim 6 includes "substantially", therefore it covers an emitter, base, collector arrangement of the bipolar transistors as shown in document D1 (see Fig. 1) or D2 (see Figs. 2,3). The subject-matter of claim 6 therefore lacks novelty (Art. 33(2) PCT).

- 3 The present application does not meet the criteria of Article 33(1) PCT, because the subject matter of claim 1 does not involve an inventive step in the sense of Article 33(3)PCT.

Document D2, discloses (see Fig. 1-4 and associated description) a bipolar transistor including collector, base (1) and emitter (2), a base metal layer having a thickness greater than 3 microns (a skilled person interprets the expression "around 3 microns" in D2, col. 5, lines 21-23 as a thickness which also encompasses values being greater than 3 microns). Reducing the specific area resistance is generally desirable (see e.g. D1: abstract). A reduction to less than 500mOhms.mm<sup>2</sup> falls within the

competence of a skilled person (lack of inventive step, Art. 33(3) PCT).

**4 DEPENDENT CLAIMS 2-5:**

Dependent claims 2-5 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect to inventive step (Article 33(3) PCT).

Metal thicknesses of 4 or 6 microns and apertures as defined in claims 2-5 are generally known, their implementation into the device of D1 or D2 fall within the competence of a skilled person, since it is generally known that voltage drops in base metal lines should be prevented (see e.g. D3, abstract).

**Re Item VIII.**

Claim 6 does not meet the requirements of Rule 6.2. PCT since it refers to a drawing although it is possible to describe the bipolar transistor with structural features. In addition the term "substantially as hereinbefore defined" is vague and covers even a bipolar transistor shown in documents D1 or D2 comprising an emitter, base and collector (see section V).

**CLAIMS**

1. A bipolar transistor, comprising:
  - a first semiconductor region of a first conductivity type defining a collector region;
  - a second semiconductor region of a second conductivity type defining a base region;
  - a third semiconductor region of said first conductivity type defining a emitter region; and
  - a metal layer providing contacts to said base and emitter regions;wherein the transistor has a specific area resistance less than  $500\text{mOhms.mm}^2$ ; and  
wherein said metal layer has a thickness greater than  $3\mu\text{m}$ .
2. A bipolar transistor according to claim 1, wherein the metal layer has a thickness no less than  $4\mu\text{m}$ .
3. A bipolar transistor according to any preceding claim, wherein the metal layer has a thickness no less than  $6\mu\text{m}$ .
4. A bipolar transistor according to any preceding claim, wherein the emitter region defines a first surface, the base region extending to said surface in locations defined by apertures through emitter region, said metal layer overlying said first surface.
5. A bipolar transistor according to claim 4, wherein adjacent apertures are spaced less than  $100\mu\text{m}$  from each other.
6. A bipolar transistor substantially as hereinbefore defined, with reference to the accompanying drawing.